NON-PUBLIC?: N
ACCESSION #: 9109090125
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Browns Ferry Unit 2 PAGE: 1 OF 05

DOCKET NUMBER: 05000260

TITLE: Manual Reactor Scram Required Due to Bulk Suppression Pool Water Temperature Exceeding Technical Specification Limit Caused by Inadequate Procedural Control
EVENT DATE: 06/29/91 LER #: 91-014-01 REPORT DATE: 08/30/91

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 001

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(i)

LICENSEE CONTACT FOR THIS LER:
NAME: Steve Austin, Licensing Engineer TELEPHONE: (205) 729-2049

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: IK COMPONENT: TR MANUFACTURER: L130
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On June 29, 1991, during performance of power ascension testing the Unit 2 reactor was manually scrammed at 0248 hours from approximately 25 megawatts thermal power due to the bulk suppression pool water temperature exceeding the Technical Specification limit of 110 degrees F. This occurred as a result of suppression pool thermal stratification while operating Reactor Core Isolation Cooling (RCIC).

The root cause of this event was inadequate procedures. Plant procedures did not provide information on the possibility for thermal stratification of suppression pool water which can result from operation of RCIC. Contributing to this event was the location of the temperature elements in the suppression pool, malfunction of the suppression chamber atmospheric temperature recorder (manufactured by Leeds & Northrup) and failure of the Shift Technical Advisor and the General Electric shift

advisor to analyze the expected torus water heatup during the plant evolution.

TVA revised the procedure for operating RCIC to note the potential for thermal stratification of the suppression pool, and to require evaluation of the necessity to initiate suppression pool cooling. Other plant procedures will be revised as necessary to add this information. TVA also issued an Operations Standing Order which specifies the expected rate of suppression pool heatup during RCIC and High-Pressure Coolant injection system operation, and when suppression pool cooling should be initiated. Operating crews were trained on the standing order and the details of this event.

END OF ABSTRACT

Description of Event

On June 29, 1991, during performance of power ascension testing activities, the Unit 2 reactor was manually scrammed at 0248 hours due to the suppression pool BT! bulk water temperature exceeding the technical specification (TS) limit of 110 degrees F. At the time the reactor was scrammed Unit 2 was in the startup/hot standby mode with reactor power at approximately 25 megawatts thermal, a reactor pressure of 845 psig and reactor moderator temperature of 508 degrees F.

On June 28, 1991 at 0644 hours the Unit 2 main turbine-generator TA! was manually tripped due to high vibration. Following the turbine trip the reactor was placed in the startup/hot standby mode. At 1600 hours, operators initiated suppression pool temperature monitoring at five minute intervals. To maintain reactor pressure, at 1605 hours on June 28, 1991 the Reactor Core Isolation Cooling (RCIC) BN! system was placed in service and aligned in the condensate storage tank (CST) to CST flow path.

At 0236 hours on June 29, 1991 a quarterly surveillance was performed which required aligning Residual Heat Removal (RHR) system BO! pump 2A for suppression pool cooling. At the time the surveillance was initiated suppression pool water temperature was stable at 87 degrees F. When the RHR pump was placed in service the suppression pool temperature increased and at 0240 hours had reached 98 degrees F, all available suppression pool cooling was placed in service. At 0245 hours the suppression pool water temperature exceeded the TS limit of 110 degrees F and the reactor was manually scrammed at 0248.

At 0320 hours, to stop further heat addition to the suppression pool, Operations personnel returned the RCIC system to standby readiness. At 0358 hours the suppression pool water temperature had decreased to 103 degrees F.

In accordance with 10 CFR 50.73(a)(2)(i)(A), TVA reports this completion of a plant shutdown required by the TS.

Analysis of Event

The major systems involved in this event were: RHR, RCIC, primary containment system temperature elements located in the suppression pool and the suppression chamber atmospheric pressure and temperature recorder IK!.

The RHR system is designed to restore and maintain coolant inventory in the reactor vessel so the core can be adequately cooled after a loss of coolant accident (LOCA). RHR also provides containment cooling so that condensation of steam resulting from blowdown of a design basis LOCA is assured. During this event the RHR system was operated in the suppression pool cooling mode to maintain suppression pool water temperature below 90 degrees F.

The purpose of the RCIC system is to provide a source of high pressure coolant makeup to the reactor vessel in case of a loss of feedwater flow. RCIC can also be used to maintain the reactor in hot standby condition. In this event the RCIC system was utilized to maintain the reactor in the hot standby mode. Reactor pressure was maintained by operating the RCIC turbine utilizing the steam generated to power it, and exhausting this steam to the suppression pool. The RCIC turbine exhausts below the top of the water in the suppression pool.

Bulk suppression pool water temperature is monitored by 16 temperature elements located near the bottom of the torus vessel. The temperature element location is such that the suppression pool water temperature in the area of the main steam relief valve discharge can be monitored.

The 16 temperature elements are grouped into two divisions of eight elements. The torus is divided into 16 "bays," and one element from each division is located in every other bay. The bulk suppression pool water temperature is the average of the eight elements in a division. Bulk suppression pool water temperature from each division is charted on separate recorders. Each recorder also has provisions to record the temperature of one of the eight individual elements. During the time the

RCIC system was operating each recorder was charting bulk suppression pool water temperature, with one of the recorders charting the temperature of the element located in the bay into which the RCIC system turbine exhausted. However, due to stratification of the hot water from the RCIC exhaust in the suppression pool, actual suppression pool water temperature was masked from these temperature elements.

The suppression chamber atmosphere temperature is charted by the suppression chamber atmospheric pressure and temperature recorder. The temperature element utilized by this recorder is located in the suppression chamber directly above the RCIC turbine exhaust. During the ten hours RCIC was operated this recorder indicated a constant temperature of 94 degrees F. This recorder was checked and found to be mechanically binding. When the recorder's operation was corrected the temperature immediately jumped to 155 degrees F.

Operations personnel placed the RCIC system in service without initiating suppression cool cooling. Plant operators made this decision based on what they considered adequate monitoring of suppression pool temperature. However, they were not aware of the potential for thermal stratification under such conditions. Plant procedures did not alert operators that thermal stratification of the suppression pool water is possible when the RCIC system is operated without suppression pool cooling. Plant operators believed that the phenomenon that they needed to be concerned with was localized heating in the area of the RCIC exhaust because of previous experience with operation of the High Pressure Coolant Inje
tion
system. Accordingly, Operations consciously established bulk suppression pool water

temperature monitoring at five minute intervals, and selected the temperature element closest to the RCIC exhaust for dedicated monitoring. Operations considered that this monitoring would provide timely indication of an increase in suppression pool water temperature, thus allowing ample time to place suppression pool cooling into service.

During the time the RCIC system was in service Operations personnel questioned why the suppression pool water temperature was not increasing even though heat was being added to the water. However, given the fact that multiple indications supported the observed suppression pool water temperature, and the heat capacity of the suppression pool is significantly larger than the heat being added by RCIC, they concluded that no temperature change was occurring.

The Shift Technical Advisor (STA) (utility, licensed) and the General Electric (GE) shift advisor (non-utility) did not identify the problem. One of the STA's duties is to evaluate transients and abnormal events from a technical basis. One of the primary job responsibilities of the GE shift advisor is to assist in the identification and evaluation of potential problems which might occur during power ascension testing when an infrequent operation is performed. Both the STA and the GE shift advisor failed to recognize the significance of no indication of torus water heatup after prolonged operation of RCIC without suppression pool cooling.

When the first RHR pump was started, it mixed the water and the actual bulk water temperature increased above the TS limit of 110 degrees F to a maximum of 118 degrees F. As required by TSs, Operations initiated the required manual reactor scram.

Although the suppression pool water temperature exceeded the TS limit, the event did not negate the ability of plant system to mitigate postulated accidents. The limiting concern with suppression pool temperature is the potential for unstable steam condensation at or near the main steam relief valve (MSRV) discharge. TVA has determined that at a reactor pressure of 1100 psig the maximum suppression pool temperature for stable steam condensation is in excess of 155 degrees F. During this event the maximum suppression pool temperature attained was 118 degrees F. Accordingly, TVA concludes that there were no safety consequences associated with this event.

Cause of the Event

The root cause of this event was inadequate procedures. Plant procedures did not provide Operations personnel with information on the possibility for thermal stratification in the torus which can result from operation of RCIC.

There were three contributing factors. First, due to the location of the temperature elements, the suppression pool temperature monitoring system did not provide accurate indication of bulk temperature.

Second, the suppression chamber temperature recorder malfunctioned and failed to provide operators with indication of increased suppression chamber temperature.

Finally, the STA and the GE shift advisor failed to analyze the expected torus water heatup during the plant evolution.

Corrective Actions

TVA has revised the operating instruction for RCIC to note the potential for thermal stratification of the suppression pool water, and to require evaluation of the necessity for initiating suppression pool cooling. TVA will also revise other plant procedures as necessary to note the potential for thermal stratification of the suppression pool and to add requirements to initiate suppression pool water cooling when activities are in progress which have the potential to increase the suppression pool temperature.

TVA issued an Operations Standing Order which provides specific details regarding the potential for thermal stratification of the suppression pool when heat is being added to it. This Standing Order specifies the expected rate of suppression pool heatup during RCIC or HPCI system operation. The Standing Order also specifies that suppression pool cooling is required whenever there exists a possibility that suppression pool water temperature could exceed 95 degrees F. TVA has trained Operations personnel on this Standing Order and the specifics of this event.

Operations management has discussed the STA's role with the STAs and reinforced their job duties and management's expectations. General Electric management has discussed the GE shift advisor's role with TVA management, and subsequently reinforced the expectations of the shift advisors with the individuals functioning in that capacity.

Previous Similar Events

None.

Commitments

Plant procedures will be revised as necessary to note the potential for thermal stratification of the suppression pool water, and to include requirements to initiate suppression pool cooling when activities are in progress which have the potential to raise the suppression pool water temperature. This will be completed by October 16, 1991.

TVA
Tennessee Valley Authority
Post Office Box 2000, Decatur, Alabama 35609

O. J. "Ike" Zeringue
Vice President, Browns Ferry Operations

AUG 30 1991

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Dear Sir:

TVA - BROWNS FERRY NUCLEAR PLANT (BFN) UNIT 2 - DOCKET NO. 50-260 - FACILITY OPERATING LICENSE DPR-52 - LICENSEE EVENT REPORT LER-50-260/91014, REVISION 1

The enclosed report provides details concerning a manual reactor scram because the suppression pool bulk water temperature exceeded the technical specification limits resulting from inadequate procedural control. This report is submitted in accordance with 10 CFR 50.73(a)(2)(i)(A).

Very truly yours,

TENNESSEE VALLEY AUTHORITY

O. J. Zeringue

Enclosure
cc: see page 2

U.S. Nuclear Regulatory Commission
AUG 30 1991

cc (Enclosure):
INPO Records Center
Suite 1500
1100 Circle 75 Parkway
Atlanta, Georgia 30339

NRC Resident Inspector, BFN

Regional Administrator

U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, Suite 2900
Atlanta, Georgia 30323

Thierry M. Ross
U.S. Nuclear Regulatory Commission
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852

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